

Introduction to the Markets, Policy, and Computation Minitrack, Electric Energy Track

Shmuel S. Oren

University of California at Berkeley

e-mail: oren@berkeley.edu

Environmental concerns regarding global warming and the adverse health effects of emissions produced by fossil fuel generation have led to a greater reliance on renewable sources of generation that are inherently variable and uncertain. This trend is accompanied by increased proliferation of distributed resources, storage and smart grid technologies that facilitate demand response and greater observability of the grid. As a result the electric power industry faces new challenges in planning and operation of the power system that require new market mechanisms and computational optimization tools to achieve productive and allocative efficiencies. Flexibility of the conventional generation resource portfolio as well as demand side flexibility are key elements of a new electricity system paradigm that can accommodate massive integration of renewables and distributed resources. Harnessing such flexibility in planning and operations imposes vast computational challenges due to the increased numbers of decision variables and the need to account for uncertainty and respond adaptively to rapidly changing conditions. Hence the central theme of this mini track revolves around identifying requirement and remuneration schemes for flexibility, characterizing market products and public policies that incentivizes flexibility and optimizing resource use to meet flexibility needs so as to assure system reliability in face of uncertainty at least cost.

This minitrack continues a long-standing tradition that evolved over the last two decades since the onset of restructuring the electric power industry in the US. Over that period HICSS has become a leading forum for discussion and outlet for research and new developments that focused on the interface between market design for the restructured

electricity industry and computational tools enabling the efficient and reliable operation of a market based power system. The minitrack consists of two sessions. The first session focuses on Market Design and Analysis. The first two papers in this session addresses capacity markets. The first deals with the impact of governance structure, while the second reevaluates capacity markets vs. energy only markets under increasing penetration of renewables. The third paper presents a German perspective where uniform energy prices prevail and discusses incentives for merchant transmission investments under such a regime.

The second session focuses primarily on power systems analytics and computation. The first paper describes an equilibrium model characterizing power markets with prosumers. The second paper describes a multifidelity model for assessing risk probabilities in power systems under rare events. The third paper explores a direct policy search framework for multiobjective

optimization of a microgrid energy management system. The fourth paper presents a modeling framework for assessing the impact of climate change in the New Zealand electricity market.

.